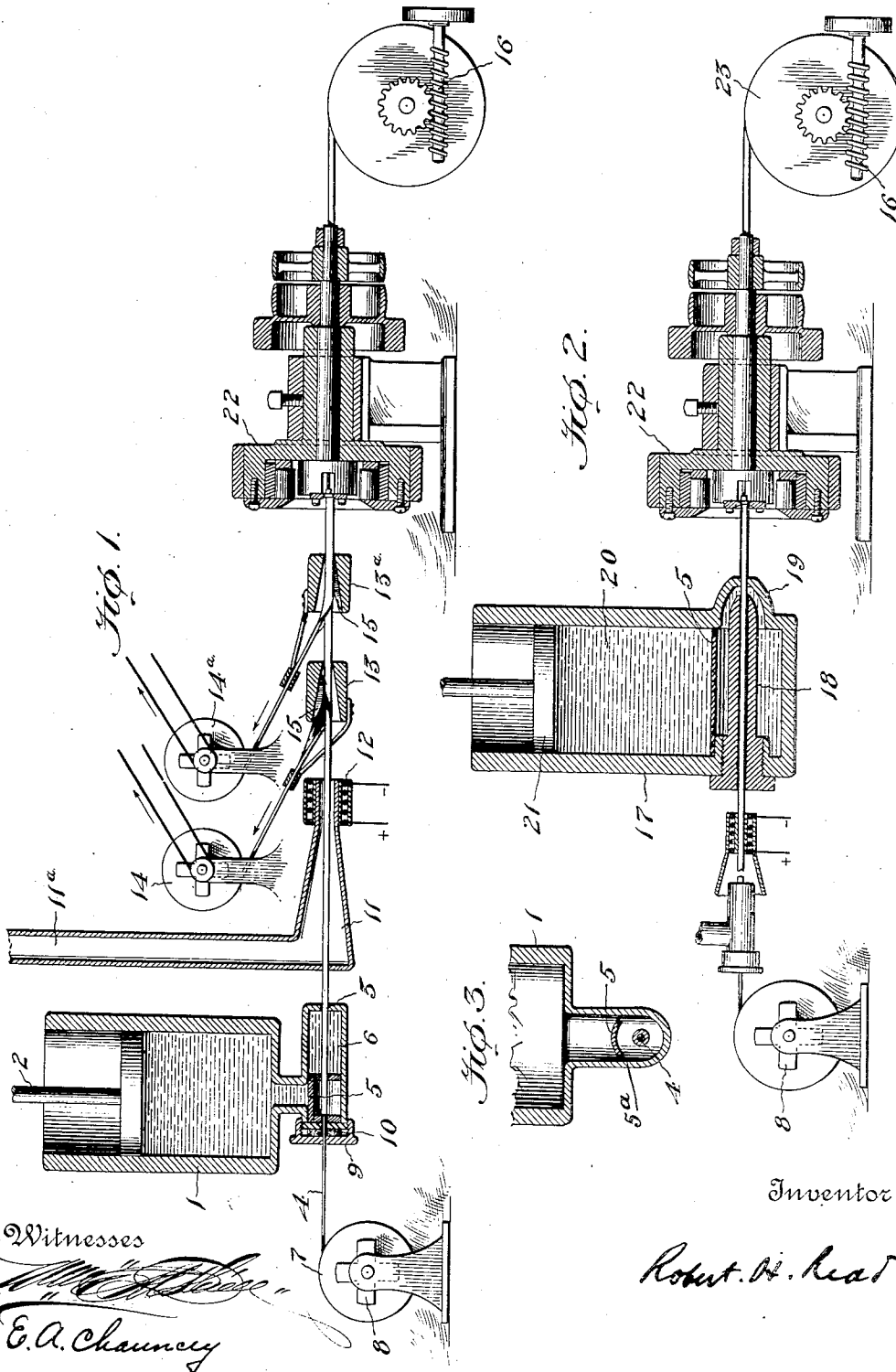


R. H. READ.
METHOD OF MAKING INSULATED WIRES.
APPLICATION FILED JAN. 3, 1914.

1,233,807.

Patented July 17, 1917.



UNITED STATES PATENT OFFICE.

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METHOD OF MAKING INSULATED WIRES.

1,233,807.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ROBERT H. READ, a citizen of the United States, residing at Washington, in the District of Columbia, have invented a new and useful Improvement in Method of Making Insulated Wires, of which the following is a specification.

This invention relates to fireproof insulated conductors of the general type described in other applications heretofore filed by me comprising a core-wire, a packing of heat refractory mineral insulation and a tubular sheath or metallic armor surrounding the latter; the wire may be one in which the core wire is of high specific resistance adapted to diffuse or distribute heat or of a good conducting metal as copper, for windings for electrical apparatus, or conduit wiring or other applications. A conductor of this kind by reason of its inclosure within mineral fireproof insulation will safely withstand any degree of heat which the metals of which it is composed will withstand. Such wire therefore is adapted for use where the apparatus may be run at a high heat either to enhance its efficiency or to accomplish a desired utility.

My present invention involves an improvement in the wire itself as well as the method or apparatus for making the same.

In carrying out my invention I employ a finished wire either of good conducting material such as copper, or high resistance material such as nickel steel, nickel chromium, nickel manganese, or other resistance wire of high specific resistance, and inclosed within a tubular metallic armor folded or squirted around it; and I interpose between the armor and the wire a compact body of heat refractory mineral insulation, the compacting being effected by means which do not produce a longitudinal strain on the conducting core. In methods heretofore proposed for making such armored wire draw bench and dies were employed to compact the insulation and reduce the cross-section of the wires; in such process the reduction of both the core and the armor is simultaneously effected, but the core being of smaller section and being relatively free to slip with respect to the armor was of necessity subjected to greater strain per unit of length, and as a result the core being gripped

with a considerable pressure by the insulation would at some points be extended more than at others, thereby producing a difference of size and carrying capacity of electric current at different points; such a result is highly objectionable and it is an important object of my invention to prevent it occurring.

To this end I provide for an absolutely uniform volume of the refractory insulation at different points along its length, and effect only such reduction in size of the armor as will suffice to produce a sufficiently compact aggregation of the mineral insulation. I accomplish this result by squirting from a die through which the conductor or resistance wire is led a tubular covering of a pasty mixture of the insulating powder with a sticky bond such as gum tragacanth and then inclose the uniformly coated wire in a tubular metallic shell curled from metal tape in forming dies, finally shrinking the armor upon the insulation by a swaging machine which produces a compact engagement of the armor and the powder without extending the length of the core-wire. To this end the amount of reduction in cross-section of the armor is previously calculated so as to merely properly compact the powder without stretching the core-wire.

My invention therefore consists in an armored conductor surrounded by uniformly compact heat refractory mineral insulation, the core-wire being of uniform cross section and the insulation being of absolutely uniform pressure and compactness relatively to the core and armor throughout its length.

The invention also comprises the method of making such conductor by coating it with a squirted mixture of heat refractory powder and a volatile or nonfluxing bond, and inclosing the same within a tightly compressing metallic armor embracing the same with uniformly tight pressure at all points throughout its length. It comprises also apparatus for carrying out these results consisting of a squirting die, tension apparatus, an armor inclosing machine, and a swaging machine. It comprises also various other features, the novelty of which will be hereinafter described and will be definitely indicated in the claims appended to this specification.

In the accompanying drawing which illustrates my invention:

Figure 1 is a diagrammatic illustration of an apparatus for making armored wire of the kind above referred to in which the armor consists of a duplicate metallic shell with staggered joints.

Fig. 2 shows an apparatus for providing the covered wire with a homogeneous metallic armor without joint.

Fig. 3 shows in section a detail of one of the parts.

Referring now particularly to the drawing, 1 in Fig. 1 represents a press containing an emulsion of mixture to be squirted around the core-wire. This mixture may be of a proper squirting consistency preferably a stiff dough composed of heat refractory finely divided powder, such as powdered flint, powdered soap-stone or other mineral insulating oxid, silicate, carbonate, or sulfate having high heat refractory insulating properties and intimately commingled with a moistening material such as a watery paste of gum tragacanth or a very weak solution say one per cent. of silicate of soda. Under the applied pressure of the piston 2, the menstruum is forced through the orifice 3 which coats the wire 4 with a stiff pasty shell; any approved arrangement of squirting die may be employed; that shown in Fig. 1 (see also Fig. 3,) comprises openings 5^a 4 through which the menstruum is delivered on both sides of a bridge-plate 5 to a chamber 6 through which the wire is led. This constitutes an effective type of squirting machine well known in the arts and requires no very detailed description.

The wire is led from a reel 7 provided with a friction-grip 8 by means of which the wire will be held under tension as it is fed forward to the press, it passes through an opening closed by a screw-cap 9 comprising a disk of leather 10 against a hole in the wall of a chamber 6, as it leaves this chamber it passes through a sheet-iron heater 11 at the delivery end of which is mounted an electric heating unit 12. In its transit from the press through the heater the coating is dried and shrinks firmly around the wire, and inasmuch as the flue 11^a for the heater is at the forward end, it is subjected to a gradual augmenting temperature by which the water is slowly and uniformly driven out, until when it arrives at the point 12 where the heater is installed it is subjected to a red heat without danger of cracks and the adhesive is either burned out, volatilized or caused to chemically incorporate with the refractory powder. In wires of this character, especially where they must withstand a high degree of heat as in the case of elements for electric heaters, rheostats or the like, the bonding material if of a fusible nature such as silicate should be in very low

percentage in order that the resulting compound when brought to a red heat may have a very high fusing point, so that it cannot in conditions of excessive overload of service fuse and combine with its core-wire. After leaving the heater 11 the wire proceeds through the dies 13 and 13^a in which a double armor is closed around it. The sheet-metal is led from reels 14—14^a provided with a tension apparatus, as a friction grip hereinbefore described, at 8 and passes over guide rollers to the curling dies 13—13^a; these dies flare at their forward end and are provided with a knife edge or blade 15 by which the seam is kept straight. The tapes leading from the reels 14—14^a may be of a desired width according to the diameter of the ultimate product; if the ultimate wire to be produced after leaving the swager was desired of a cross-section of forty mils the tapes should be approximately one-eighth of an inch wide and may be eight mils and upward in thickness as desired. The dies 13—13^a should have a gradual taper as indicated, and should be so proportioned that the tubular envelops formed at their discharge ends shall just lightly inclose the coated wire. The compound wire then leaves the final curling die with a double metallic shell the joints of which are staggered 180 degrees relatively to one another, thus lapping joints and preventing any effusion of the powdered matter when it reaches the swager. In passing through the swager the hammer blows delivered radially shrink the compound covering into an exceedingly compact relation to the powder and cause it to firmly grip the core-wire. Further, the powder is crushed or broken into molecularly fine fragments with the greatest uniformity. The swager illustrated is of a well known type, comprising fast and loose pulleys and a revolving head which delivers hammer-blows with exceeding rapidity radially around the wire and absorbs all elongation, the wire assuming a perfectly cylindrical form after passing through the axis of the swager. As indicated, it is wound upon a large reel fed forward by a worm-gear 16 driven by a suitable source of power. It will be noted that the tension on the tapes is all rearward of the swager; from this it results that no tension of any consequence is exerted upon the core wire and there is no tendency for that reason for the latter to be strained or elongated. The tension of the reels 14—14^a hold the wire taut and absorb all elongation of the shell tapes. If desired, these reels may have a spring take-up to hold the tapes taut, as the action of the swager tends to reduce the size of the armor at its mouth, and to this end the hammers of the swager may have a slightly flaring opening in the direction of the reels 14—14^a to permit the

tension reels to absorb the shrinking metal. In Fig. 2 I have shown a modification in which the coated wire is covered with a homogeneous covering of metal instead of one with a seam. In Fig. 1 will be seen a wire with a longitudinal seam, which should be brazed or soldered as it leaves the swager to prevent opening under the influence of heat, especially with such apparatus as is intended for electric heating purposes; but in the form shown in Fig. 2 the wire is provided with an integral covering of lead or other metal; to this end the wire after leaving the reel 8 is led through the coating press and thence through a heater to a pipe press 17, passing through a hollow mandrel 18 to the coating die 19 at which it is covered with lead or other metal from a font 20 operated by a ram or piston 21. After passing through the press the wire has an integral cylindrical shell of lead or other metal and passes to the swager 22, in which it is firmly closed upon and compacts the refractory insulation upon the wire; thence it is delivered to a reel 23 in a manner described in Fig. 1.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent in the United States is:

1. The method of making fireproof armored conductors for electric heating or other translating devices which heat in use, consisting in covering a core-wire with a menstruum of heat refractory insulating powder and a destructible binder containing a low percentage of fusible binder, slowly heating it to produce a compound infusible at a red heat, and finally inclosing it in a compacted metallic armor.

2. The method of making a fireproof armored conductor, consisting in covering a core-wire with a menstruum of heat refractory insulating powder containing an organic binder, then shrinking the menstruum and destroying the binder by heat, then covering the menstruum with a metallic armor.

3. The method of making fireproof armored conductors, consisting in covering a core-wire with a menstruum of heat refractory insulating powder containing an organic binder, then shrinking the menstruum

and destroying the binder by heat, and covering the menstruum with a seamless metallic armor.

4. The method of making fireproof armored conductors, consisting in covering a core-wire with a menstruum of heat refractory insulating powder containing an organic binder, then shrinking the menstruum and destroying the binder by heat, then covering the menstruum with a seamless armor.

5. The method of making fireproof armored conductors, consisting in covering a core-wire with a coherent menstruum of a heat refractory insulating powder and a binder, then drying it out, then swaging by hammer-blows delivered radially a metallic armor around the menstruum to crush it to fine powder, and simultaneously compact it on the core.

6. The method of making fireproof armored conductors, consisting in covering a core-wire with a coherent menstruum of a heat refractory insulating powder and a binder, drying it out, compacting the powder radially in a metallic tube by reducing the diameter of the tube, and simultaneously putting tension on the armor to avoid reducing the section of the core-wire or subjecting it to longitudinal strain.

7. The method of making fireproof insulated wire, consisting in carrying a conductor through a bath of heat refractory plastic insulating material, shrinking the covering and hardening it, surrounding it with metallic armor, reducing the section of the armor to compact the insulation without reducing the core wire, and putting tension on the extruded metal behind the reducing means to take up the slack.

8. The method of making fireproof insulated wire, consisting in squirting a menstruum of heat refractory insulating powder and a binder around a core wire, drying the menstruum, squirting a metallic armor around the menstruum, and shrinking the armor tight on the core wire without stretching or reducing the core wire.

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Witnesses:

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